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RECTAL INSUFFLATION WITH HYDROGEN GAS
AS A DIAGNOSTIC MEASURE.

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**TWO CASES OF GUNSHOT WOUND OF THE
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CASE I.—J. J., sixteen years of age, was out hunting with some companions on Sunday, September 9, 1888, one of whom accidentally discharged his 22-calibre rifle at a distance of about one hundred and fifty feet, the bullet striking the patient in the abdomen. The injury caused but little pain, and immediately after the accident the patient walked about forty yards to a farm-house, where he was placed in bed. From there he was conveyed on a cot, in a farmer's wagon, to the Milwaukee Hospital, some six miles distant. The accident occurred about noon, and he arrived at the hospital at 3 P.M.

Examination.—Boy complains of considerable pain in the abdomen; pulse 80 and soft; his general appearance indicates no serious injury. On

undressing him, a bullet wound, with omentum protruding, was found two inches to the right of the middle line, and on a level with the anterior superior spine of the ileum. Left iliac region dull on percussion; and in right, a cracked-pot sound was elicited on percussion. A rectal enema was administered, and was followed by a free fecal discharge, without admixture of blood. (On washing the feces afterward the bullet was found.)

Operation.—Ether, as an anæsthetic; thorough disinfection of abdominal wall; rectal insufflation of hydrogen gas, followed by the escape of bubbles of the gas, within a few seconds, at the wound of entrance, into which had been placed a hæmostatic forceps, the blades separated so as to render the canal patent. The gas was lighted, and after thorough cauterization of the wound by the flame, the flame was extinguished by the application of a wet sponge.

Laparotomy by median incision, eight inches in length, from pubes upward. About a pint of fluid blood in the peritoneal cavity, and hemorrhage continuing from the mesenteric veins at two points of perforation on the mesenteric side of the bowel, and to a less extent from perforations of the mesentery; arrested by ligating *en masse*. Within a distance of four feet, near the middle of the ileum, were found ten perforations, two of which were at the mesenteric border; also four perforations of the mesentery. Another perforation of the bowel was found within four inches of the ileo-cæcal valve on the convex side of the intestine, making so far eleven in all. All were closed by Czerny-Lembert sutures. At two points the perforations were so close together that it was found necessary to invert half the circum-

ference of the bowel on the convex side, thus producing considerable narrowing of its lumen.

Two hours had been consumed in arresting the hemorrhage and closing the eleven perforations, and the patient at this time had become pulseless, and yet it was deemed absolutely necessary to determine beyond all doubt if any more perforations existed by repeating the rectal insufflation of hydrogen gas. On repeating this test it was found that gas escaped freely from the pelvic cavity, without reaching the ileo-cæcal region, showing that at least one more perforation was below this point. The sigmoid flexure was brought into the wound and compressed between the index finger and thumb. Insufflation was again followed by escape of gas, demonstrating that the perforation was below this point. Inch by inch the bowel was examined by this method in a downward direction, until a perforation was found in the anterior portion of the rectum at a point where the peritoneum covering its anterior wall is reflected upon the bladder. This perforation was rendered accessible to direct treatment by an assistant making traction on the colon and by keeping the margins of the wound well retracted by means of a pair of Hegar's retractors. It was closed by five Lembert sutures, with the greatest difficulty, on account of its deep situation and inadequate light, which was furnished by two candles.

From the perforations in the ileum there escaped pieces of green apples and intestinal contents, and from that in the rectum fluid feces.

The peritoneal cavity was freely irrigated with a one-third per cent. solution of salicylic acid. After completion of peritoneal toilet, a glass drain was introduced in such a manner that the distal open end

was placed opposite the sutured rectal wound, and the abdominal incision closed in the usual manner.

Whiskey was freely administered hypodermatically during the operation and after its completion, as the patient remained pulseless for half an hour.

Time of operation two and a half hours.

The foot of the bed was elevated and dry heat applied to the extremities.

10 P. M. Temp. 99.5° F.; pulse rapid and weak. About one ounce of bloody serum withdrawn from glass drain.

Sept. 10, 8 A. M. Temp. 99° F.; pulse 126. Clear serum only in the drain; about one drachm withdrawn every three hours. During the day the patient was slightly delirious, and in the absence of the nurse he got out of bed and walked across the ward to another bed.

8 P. M. Temp. 99.8° F.; pulse 144. Some tympanites. Ordered one drachm of turpentine in half a pint of warm water, as an enema, which was followed by free discharge of feces and flatus.

11th. Temp. normal; pulse 104. Natural passage from bowels; delirium continues.

12th. Temp. normal; pulse 96; delirium disappeared. Allowed liquid food in small quantities.

13th. Pulse 72. The contents of the glass drain have a suspicious fecal odor. Glass replaced by rubber drain. Slight diarrhœa, which relieved the tympanites.

14th. A fecal fistula has formed along the track of the drainage-tube. Large rubber tube introduced through the anus, and left in rectum to allow free escape of fluid feces. Fluid injected into fistula does not flow through the rectal tube. Rectum disinfected every four hours with saturated salicylic acid solution.

9 A.M. Temp. 101° F. ; pulse 126.

17th. Temp. normal; pulse 108. Free discharge of fluid feces from rectal tube and fistula.

18th. Sutures removed from the abdominal incision; only deep parts united, granulating surfaces approximated by strips of adhesive plaster over an antiseptic compress.

19th. Fluid flows freely from fistula through the rectal tube. No feces have escaped through fistula for twelve hours.

20th. Rectal tube withdrawn, followed by return of fecal discharge through fistula.

Oct. 1. The discharge of feces through the fistula has been gradually diminishing, and has now ceased.

19th. Fistulous track completely closed. Abdominal incision all healed, except a small granulating surface at lower angle.

Patient discharged cured, November 3d.

REMARKS.—The subjective symptoms in this case four hours after injury, and after transporting the patient a distance of six miles, furnished no indications whatever of the extent of visceral injury which was found on exploring the abdominal cavity. The rectal insufflation of hydrogen gas at once rendered the diagnosis positive, and pointed out the necessity of treatment by abdominal section. Eleven perforations were found and sutured without much difficulty, but the last perforation in the deepest portion of the pelvis could not have been found by any other means of diagnosis short of rectal insufflation. Had this perforation been overlooked death from septic peritonitis would have been inevitable. Drainage was resorted to in this case, not only from the fact

that fecal extravasation had taken place, but also for the reason that owing to the difficulty in gaining access to the rectal wound I feared that the suturing was not as perfect as it should be, and by proper drainage I wished to prevent possible extravasation into the peritoneal cavity from this cause. Subsequent events showed the propriety of this precaution.

CASE II.—J. E. (case of Drs. Gudden, Steele, and Gordon, of Oshkosh), eighteen years of age, was out target-shooting with a companion, who, while raising his 22-calibre rifle to his shoulder, accidentally discharged it; the bullet struck the patient in the abdomen. He was about forty feet distant, and almost directly facing his companion. When first seen by Dr. Gudden, within half an hour after the injury was received, he was suffering severe pain in the abdomen, was pale, covered with cold, clammy perspiration, and vomited frequently. He was placed in a carriage and conveyed to his home, a distance of two miles. During the journey, the severity of the abdominal pain was so increased by the motions of the carriage as to necessitate repeated stops.

I saw the patient, with the above-named physicians, October 9th, 4 A.M., twelve hours after the accident.

Examination.—The wound of entrance was found to be at the outer margin of the left rectus about one inch below the level of the umbilicus. Abdomen dull on percussion in left iliac region, pulse 140, temperature 100° F. Penetration of the abdomen was proved by the introduction of a grooved director, which was left in place during the insufflation of the hydrogen gas.

The patient was placed under the influence of chloroform, and during the operation the narcosis was maintained with ether. The abdomen was thoroughly disinfected, and rectal insufflation of hydrogen gas practised to ascertain if any perforation of the intestine existed. Under a pressure of about a half a pound to the square inch, and the use of one-quarter of a gallon of gas, in a few minutes the gas escaped along the groove of the director, and, on applying a match, lighted as it escaped. The flame was now extinguished by a moist sponge, and the abdomen opened by a median incision, five inches in length, extending from the umbilicus to near the pubes.

On exposing the peritoneum at the lower angle of the incision, through this membrane there was observed a structure closely resembling an over-distended bladder. That this structure was a distended bladder was improbable as the boy had urinated before the anæsthetic was administered. The peritoneum was carefully incised between two forceps and divided upon a grooved director to the same extent as the external incision, and it was then discovered that what appeared to be an over-distended bladder was a coil of small intestine distended with blood to twice its normal size. The whole pelvic cavity was found filled with fluid blood. On withdrawing the small intestine, five perforations near the junction of jejunum and ileum, and within a distance of three feet, were found; four occurred in pairs on the lateral aspect of the bowel, and one at the mesenteric attachment. All the perforations were disproportionately large to the size of the bullet and would easily admit the tip of the index-finger. The intestine, at the point of injury, was covered with a thick layer of recent plastic lymph, and the parietal peri-

toneum presented all the evidences of a beginning diffuse septic peritonitis. The intestine, which was over-distended by blood-clots for about three feet, was emptied and irrigated with a one-third per cent. solution of salicylic acid, which was used for constant irrigation during the entire time required in suturing the perforations, which were closed by Czerny-Lembert sutures.

Further examination disclosed four perforations of the mesentery, from two of which quite profuse venous hemorrhage was still going on. The hemorrhage was arrested by ligature *en masse*, by passing a needle, threaded with fine silk, through the entire thickness of the mesentery, on either side of the perforations.

Rectal insufflation of hydrogen gas was repeated so as to ascertain if any other perforations existed, and the gas after it had been gently forced beyond the highest perforation was made to traverse the balance of the entire intestinal canal by drawing forward loops of the intestine and returning them as examined without further insufflation. This procedure was found entirely satisfactory and practical, as the gas on account of its low specific gravity readily entered the highest point in the prolapsed intestinal loop.

The abdominal cavity was irrigated with salicylic acid solution, numerous coagula removed, the toilet completed, a glass drain introduced into the pelvis, and the abdomen closed.

Duration of operation two hours. Patient collapsed, pupils greatly dilated, and almost pulseless in spite of repeated hypodermatic injections of brandy, which were administered when signs of collapse became apparent, throughout the operation. Enema of a teacupful of warm water and two

ounces of brandy. Foot of bed elevated and external dry heat applied.

In an hour and a half he rallied somewhat from the operation, but again sank and died at 3 P.M., eight hours after the completion of the operation.

Post-mortem eighteen hours after death (Drs. Steele, Gudden, Gordon). Circumscribed peritonitis present at time of operating, now diffuse; very little fluid in abdominal cavity; several small blood-clots in vicinity of transverse colon. The perforations were all securely closed, and the bullet was found in the soft tissues to the right of the spinal column, between the fourth and fifth lumbar vertebræ, and near the ascending colon. The bullet though only of 22-calibre was oblong and may thus explain the unusually large size of the perforations.

REMARKS.—This case compared with the foregoing furnishes a strong argument in favor of early operative interference in cases of gunshot or stab wounds of the abdomen in which the existence of visceral lesions can be demonstrated by rectal insufflation of hydrogen gas. In the first case, although twelve perforations were found and sutured, and fecal extravasation had taken place, no evidences of peritonitis were found, and the patient recovered. In this case twelve hours intervened between the time the injury was received and the treatment by laparotomy, during which time a septic peritonitis had developed, the extension of which the operation did not arrest, and from the effects of which the patient died.

